

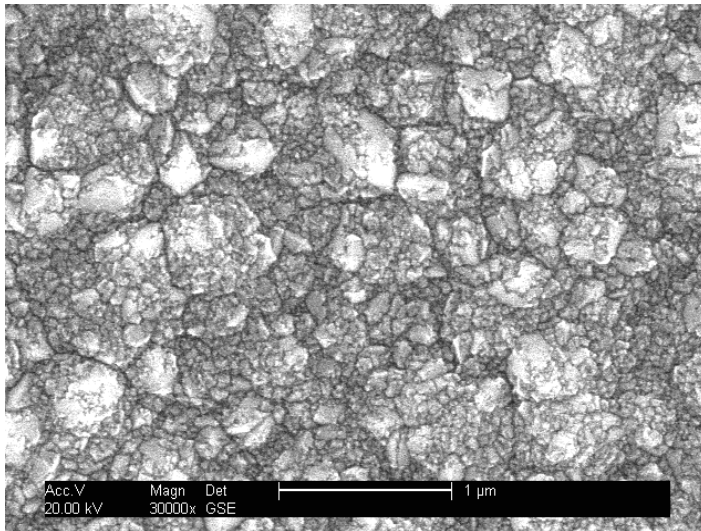
# COLLABORATIVE/FRG RESEARCH: NANO-STRUCTURED MATERIALS OF COVALENTLY BONDED NETWORKS

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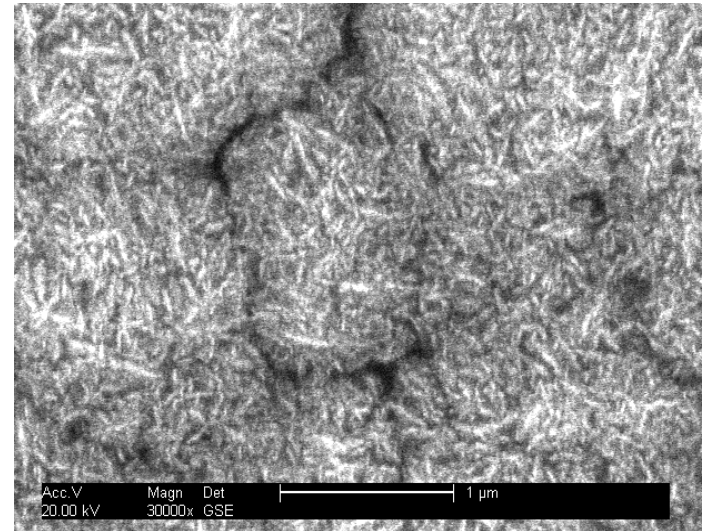
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**Objectives:** The primary scientific objectives of this focussed research group (FRG) project is to: synthesize unusual C-based covalently-bonded amorphous and nanocrystalline materials with controlled nano-structures and properties in the focussed region of the ternary (C-B-N) system, develop/apply advanced techniques to characterize the nano-structures of these materials, and relate the scale of the nano-structure to the selected properties.

**Results:** Our research during this year was aimed at studying the effect of nitrogen in the plasma on the synthesis of nanocrystalline thin films in the C-N system starting from diamond. Depending on the nitrogen level, films of different grain sizes in the nm range were synthesized. A significant  $N_2$  in the plasma affected the diamond lattice/structure in a significant way as revealed by Raman spectroscopy.

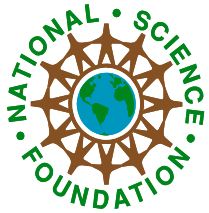


(A)



(B)

(A) Microcrystalline-(grain size 188 nm / 0.6%  $N_2$  in plasma), and (B) nanocrystalline-(grain size 20 nm / 95%  $N_2$  in plasma) diamond thin films deposited on Si wafers using microwave plasma enhanced CVD



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### Education and Outreach

Two graduate students and a research associate contributed to this project. One of the graduate students and research associate worked on the synthesis of the films by microwave plasma enhanced chemical vapor deposition technique (MPECVD) and another student worked on the characterization of these films using Raman Spectroscopy and X-ray diffraction techniques. These students attended the Annual Meeting of the American Ceramic Society in Indianapolis in 2004 to present a paper, learn from other researchers in this field, and broaden their professional outlook. An undergraduate student was also exposed to research on the synthesis of diamond thin films using MPECVD technique. Our facility on MPECVD is toured by prospective students and parents of our department on a weekly basis, and other visitors to college of engineering, which included US Congressman and Deputy Secretary of the Department of Energy.